

U.S. DEPARTMENT OF TRANSPORTATION

**NATIONAL HIGHWAY TRAFFIC SAFETY
ADMINISTRATION**

LABORATORY TEST PROCEDURE

FOR

FMVSS 213

Child Restraint Systems



ENFORCEMENT
Office of Vehicle Safety Compliance
Room 6111, NVS-220
400 Seventh Street, SW
Washington, DC 20590

OVSC LABORATORY TEST PROCEDURE NO. 213
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1. PURPOSE AND APPLICATION

The Office of Vehicle Safety Compliance (OVSC) provides contracted laboratories with Laboratory Test Procedures (TPs) which serve as guidelines for obtaining compliance test data. The data are used to determine if a specific vehicle or item of motor vehicle equipment meets the minimum performance requirements of the subject Federal Motor Vehicle Safety Standard (FMVSS). The purpose of the OVSC Laboratory Test Procedures is to present a uniform testing and data recording format, and provide suggestions for the use of specific equipment and procedures. Any contractor interpreting any part of an OVSC Laboratory Test Procedure to be in conflict with a Federal Motor Vehicle Safety Standard or observing any deficiencies in a Laboratory Test Procedure is required to advise the Contracting Officer's Technical Representative (COTR) and resolve the discrepancy prior to the start of compliance testing.

Contractors are required to submit a detailed test procedure to the COTR before initiating the compliance test program. The procedure must include a step-by-step description of the methodology to be used.

The OVSC Laboratory Test Procedures are not intended to limit or restrain a contractor from developing or utilizing any testing techniques or equipment, which will assist in procuring the required compliance test data.

NOTE: The OVSC Laboratory Test Procedures, prepared for use by independent laboratories under contract to conduct compliance tests for the OVSC, are not intended to limit the requirements of the applicable FMVSS(s). In some cases, the OVSC Laboratory Test Procedures do not include all of the various FMVSS minimum performance requirements. Sometimes, recognizing applicable test tolerances, the Test Procedures specify test conditions, which are less severe than the minimum requirements of the standards themselves. Therefore, compliance of a vehicle or item of motor vehicle equipment is not necessarily guaranteed if the manufacturer limits certification tests to those described in the OVSC Laboratory Test Procedures.

2. GENERAL REQUIREMENTS

The test procedures, methods, and associated equipment are based on the requirements of the following documents to the extent referenced herein.

49 CODE OF FEDERAL REGULATIONS (CFR) 571 FEDERAL MOTOR VEHICLE SAFETY STANDARDS (FMVSS)

FMVSS 213 - Child Restraint Systems

FMVSS 209 - Seat Belt Assemblies

FMVSS 302 - Flammability of Interior Materials

49 CODE OF FEDERAL REGULATIONS (CFR) 572 ANTHROPOMORPHIC TEST DEVICES

Subpart C - Three-Year-Old Child

Subpart I - Six-Year-Old Child

Subpart J - Nine-Month-Old Child

Subpart K - Newborn Infant

STANDARD BENCH SEAT -- Drawing Package SAS-100-1000, revised December 30, 1980, and including Addendum A, dated July 1, 1993.

AMERICAN ASSOCIATION OF TEXTILE CHEMISTS AND COLORISTS (AATCC)

AATCC Geometric Gray Scale

AATCC Test Method 30-81 Fungicides Evaluation of Textiles; Mildew and Rot Resistance of Textiles

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM B117-73 Standard Method for Salt Spray (Fog) Testing

ASTM D756-78 Standard Practice for Determination of Weight and Shape Changes of Plastics Under Accelerated Service Conditions

ASTM D1056-73 Standard Specification for Flexible Cellular Materials--Sponge or Expanded Rubber

ASTM D1564-71 Standard Methods of Testing Flexible Cellular Materials--Slab Urethane Foam

2. GENERAL REQUIREMENTS....Continued

ASTM D1565-76 Standard Specifications for Flexible Cellular Materials--Vinyl Chloride Polymers and Copolymers (Open-Cell Foam)

ASTM E4-79 Standard Methods of Load Verification of Testing Machines

ASTM G23-81 Standard Practice for Operating Light Exposure Apparatus (Carbon Arc Type) with and without Water for Exposure of Nonmetallic Materials

SOCIETY OF AUTOMOTIVE ENGINEERS (SAE)

SAE J211 Instrumentation for Impact Tests

AMERICAN NATIONAL STANDARDS INSTITUTE

ANSI/NCSL Z540-1-1994 Calibration System Requirements

MILITARY STANDARD

MIL-SPEC 43006 Nylon Impregnated Vinyl

ENVIRONMENTAL CONDITIONS

Unless otherwise specified, all tests and measurements shall be conducted under the following environmental conditions:

Temperature	19°C (66°F) to 26°C (78°F)
Relative Humidity	10% to 70%

All data on environmental conditions required throughout this procedure shall be continuously and permanently recorded on strip charts, circular charts, or other acceptable printout media.

TEST SEQUENCE

The overall organization of this test procedure is shown in Figure 1 on the next page. The following three test series may be done simultaneously or sequentially in any order.

MATERIALS TESTS (shown in Figures 2 through 6)

INSPECTION OF PHYSICAL FEATURES (shown in Figure 7)

DYNAMIC IMPACT TEST (shown in Figure 8)

Additional tests are required for child restraint systems manufactured for use in aircraft in addition to motor vehicle.

TESTING FOR AIRCRAFT USE (shown in Figure 9)

2. GENERAL REQUIREMENTS....Continued

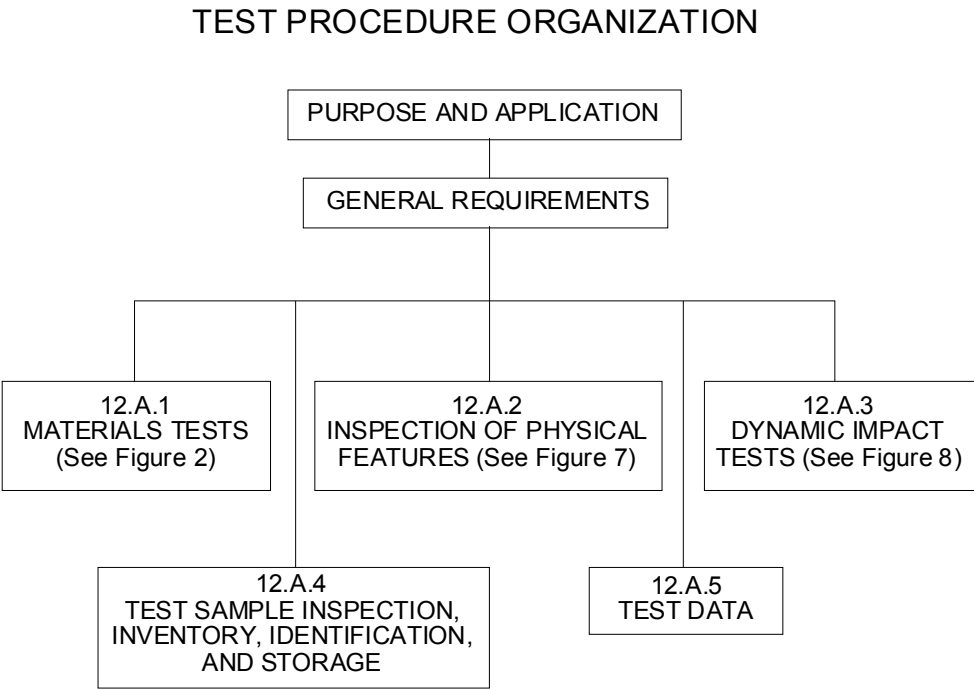


FIGURE 1

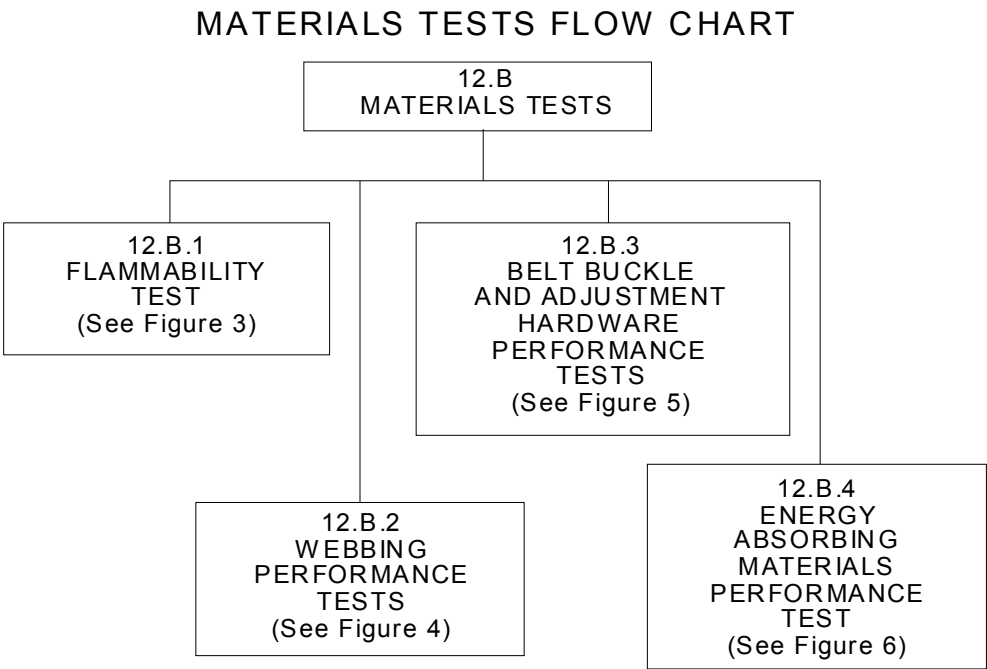


FIGURE 2

2. GENERAL REQUIREMENTS....Continued

FLAMMABILITY TEST FLOW CHART

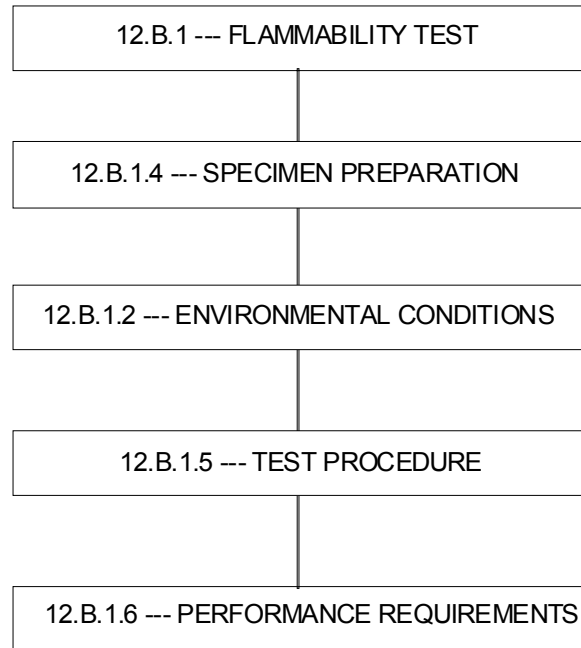


FIGURE 3

WEBBING PERFORMANCE TESTS FLOW CHART

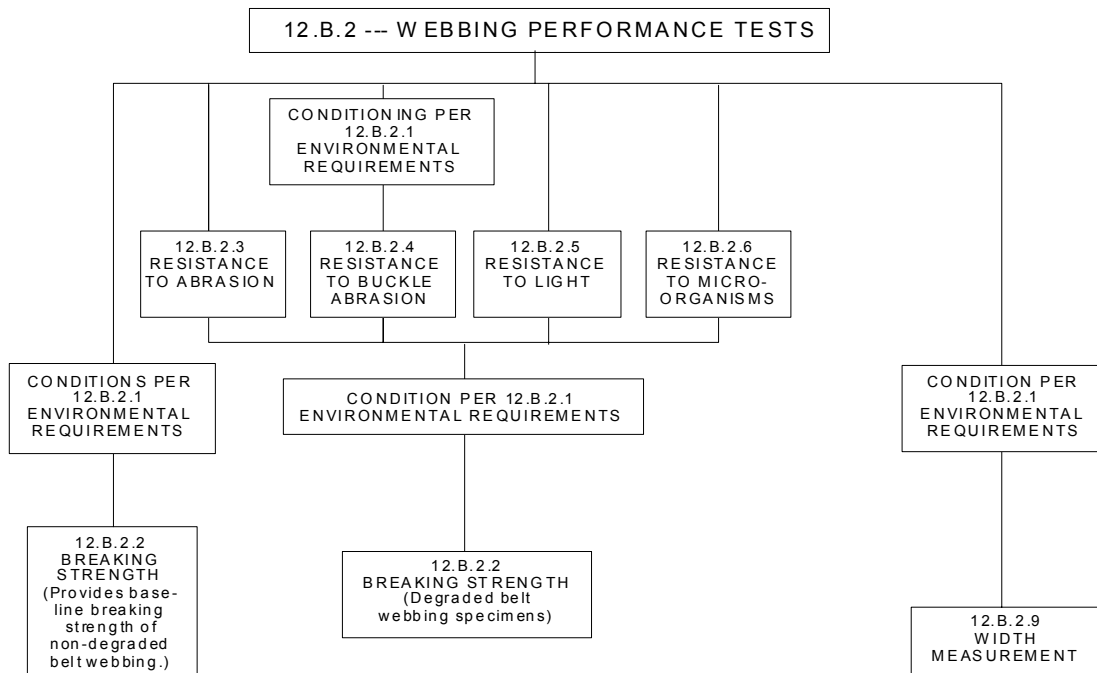


FIGURE 4

2. GENERAL REQUIREMENTS....Continued

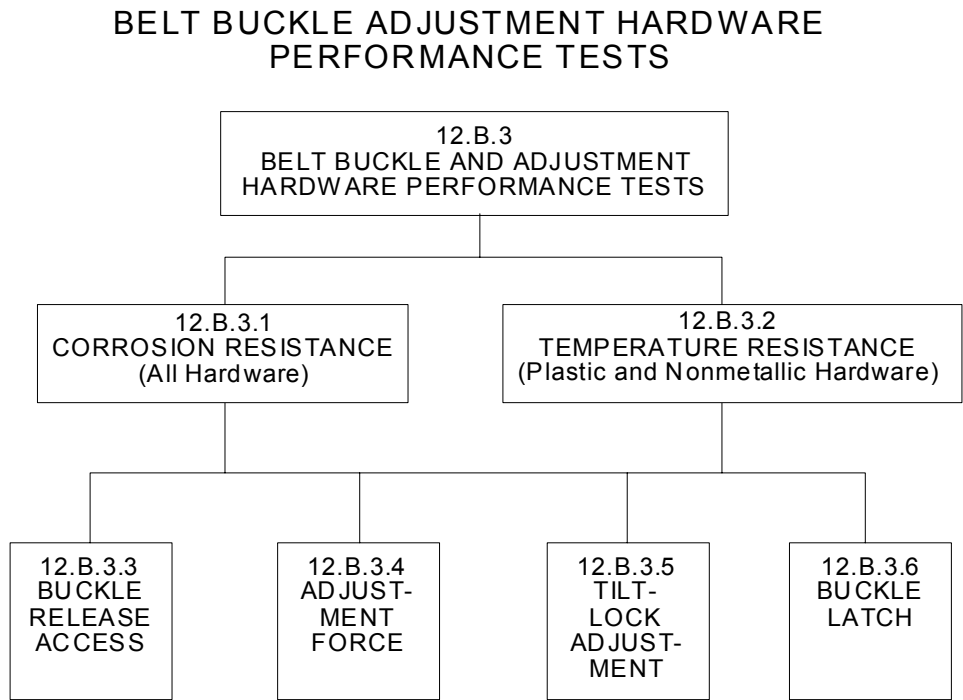


FIGURE 5

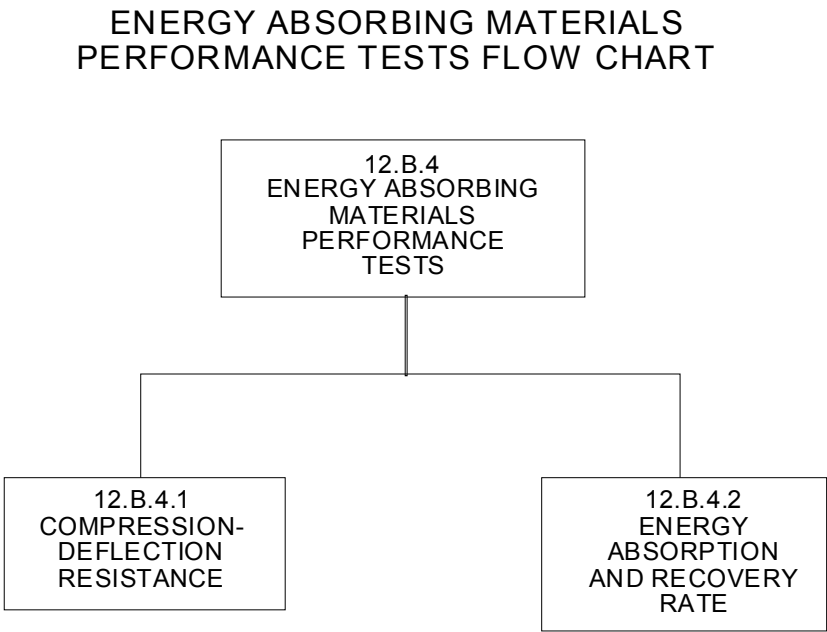


FIGURE 6

2. GENERAL REQUIREMENTS....Continued

INSPECTION OF PHYSICAL FEATURES FLOW CHART

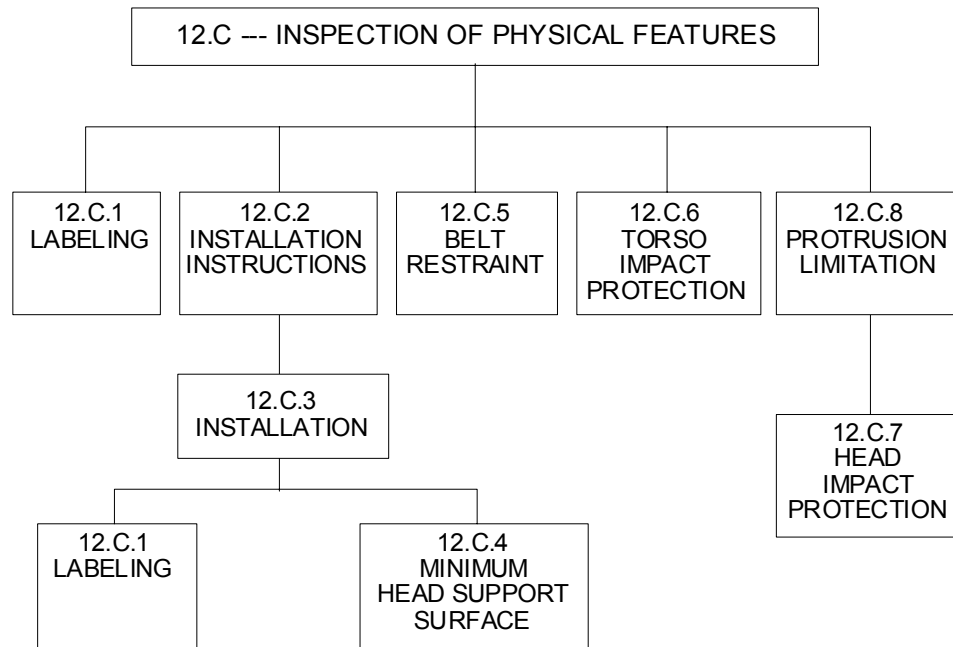


FIGURE 7

DYNAMIC IMPACT TEST FLOW CHART

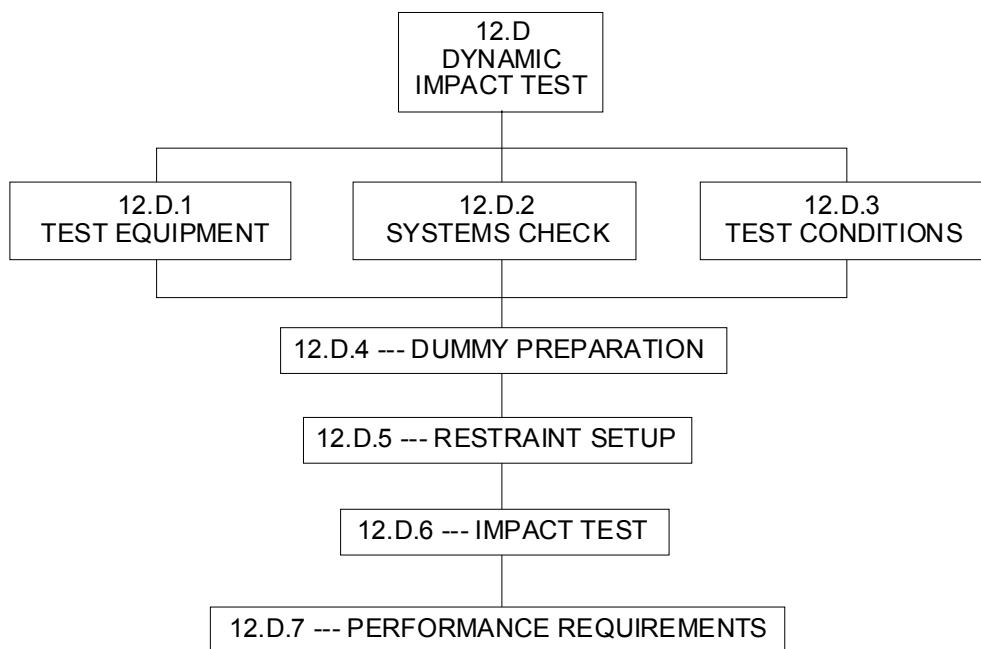


FIGURE 8

2. GENERAL REQUIREMENTS....Continued

FAA INVERSION
PERFORMANCE TEST FLOW

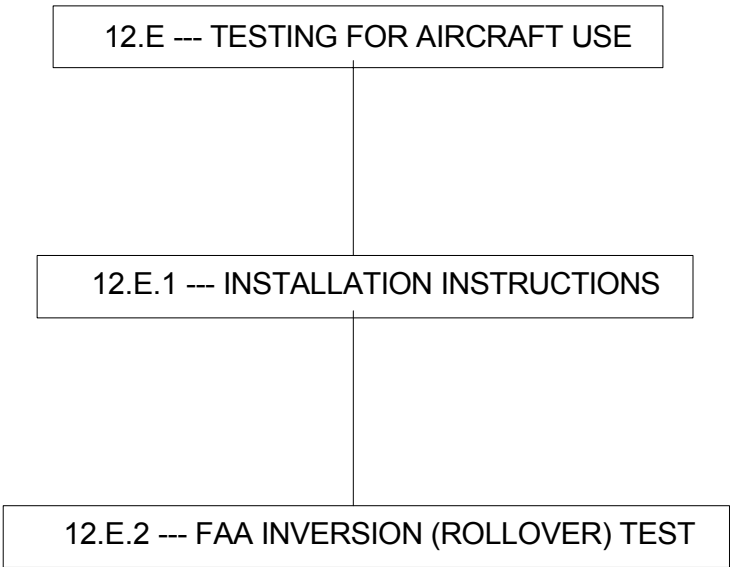


FIGURE 9

Any interpretations and/or deviations from this Test Procedure shall be shown in Appendix A of the Final Test Report.

3. SECURITY

The contractor shall provide appropriate security measures to protect the OVSC test equipment from unauthorized personnel during the entire compliance-testing program. The contractor is financially responsible for any acts of theft and/or vandalism, which occur during the storage of test equipment. Any security problems, which arise, shall be reported by telephone to the Industrial Property Manager (IPM), Office of Contracts and Procurement, within two working days after the incident. A letter containing specific details of the security problem will be sent to the IPM (with copy to the COTR) within 48 hours. The contractor shall protect and segregate the data that evolves from compliance testing before and after each test. No information concerning the safety compliance-testing program shall be released to anyone except the COTR, unless specifically authorized by the COTR or the COTR's Supervisor.

NOTE: NO INDIVIDUALS, OTHER THAN CONTRACTOR PERSONNEL DIRECTLY INVOLVED IN THE COMPLIANCE TESTING PROGRAM, SHALL BE ALLOWED TO WITNESS ANY EQUIPMENT COMPLIANCE TEST UNLESS SPECIFICALLY AUTHORIZED BY THE COTR.

4. GOOD HOUSEKEEPING

Contractors shall maintain the entire equipment compliance testing area, test fixtures and instrumentation in a neat, clean and painted condition with test instruments arranged in an orderly manner consistent with good test laboratory housekeeping practices.

5. TEST SCHEDULING AND MONITORING

The contractor shall submit a test schedule to the COTR prior to testing. Tests shall be completed as required in the contract. All testing shall be coordinated to allow monitoring by the COTR.

6. TEST DATA DISPOSITION

The contractor shall make all equipment preliminary compliance test data available to the COTR on location within four hours after the test. Final test data, including digital printouts and computer generated plots (if applicable), shall be furnished to the COTR within five working days. Additionally, the contractor shall analyze the preliminary test results as directed by the COTR.

All backup data sheets, strip charts, recordings, plots, technicians' notes, etc., shall be either sent to the COTR or retained by the contractor for a minimum of five years.

7. GOVERNMENT FURNISHED PROPERTY (GFP)

ACCEPTANCE OF TEST EQUIPMENT

All equipment items will be inventoried upon receipt and checked against the shipping documents. Any missing or broken parts will be reported immediately to the COTR. A running inventory list will be maintained until the complete matrix list of test samples is received.

The three-year-old dummy (Part 572C), six-year-old dummy (Part 572I), nine-month-old dummy (Part 572J) and the newborn infant dummy (Part 572K) will be provided to the laboratory by OVSC. The three-year-old and six-year-old dummies shall be calibrated by the laboratory before the start of the test program, after an apparent noncompliance with the Dynamic Impact Test requirements (unless waived by the COTR), after 30 tests, or if the dummy has been in storage for thirty days or more during a testing program. The dummy shall not be used for more than one test per hour. The nine-month-old, three-year-old, and six-year-old dummy calibration procedures are attached to this Test procedure as Appendix A, B, and C, respectively. The newborn size dummy shall be visually inspected at the start of the test program and after an apparent noncompliance with the dynamic Impact Test requirements to check for cracks, tears or other physical damage and either repaired or replaced at the discretion of the COTR.

8. CALIBRATION OF TEST INSTRUMENTS

Before the contractor initiates the safety compliance test program, a test instrumentation calibration system will be implemented and maintained in accordance with established calibration practices. Guidelines for setting up and maintaining such calibration systems are described in ANSI/NCSL Z540-1-1994, "Calibration System Requirements". The calibration system shall be set up and maintained as follows:

- A. Standards for calibrating the measuring and test equipment will be stored and used under appropriate environmental conditions to assure their accuracy and stability.
- B. All measuring instruments and standards shall be calibrated by the contractor, or a commercial facility, against a higher order standard at periodic intervals NOT TO EXCEED TWELVE (12) MONTHS! Records, showing the calibration traceability to the National Institute of Standards and Technology (NIST), shall be maintained for all measuring and test equipment.
- C. All measuring and test equipment and measuring standards will be labeled with the following information:
 - (1) Date of calibration
 - (2) Date of next scheduled calibration
 - (3) Name of the technician who calibrated the equipment
- D. A written calibration procedure shall be provided by the contractor which includes as a minimum the following information for all measurement and test equipment:
 - (1) Type of equipment, manufacturer, model number, etc.
 - (2) Measurement range
 - (3) Accuracy
 - (4) Calibration interval
 - (5) Type of standard used to calibrate the equipment (calibration traceability of the standard must be evident)
- E. Records of calibration for all test instrumentation shall be kept by the contractor in a manner, which assures the maintenance of established calibration schedules. All such records shall be readily available for inspection when requested by the COTR. The calibration system will need the acceptance of the COTR before the test program commences.
- F. The equipment list and calibration schedules shall be included in the Final Test Report as Appendix B.
- G. The laboratory shall prepare a worst-case error analysis of the Dynamic Impact Test instrumentation to show the ability of the instrumentation to determine whether a restraint system complies with the standard. This analysis shall include all potential measurement variables.

9. PHOTOGRAPHIC DOCUMENTATION

DYNAMIC TEST

Each final test report shall include glossy color photographs of the test item as received by the COTR. The following format shall be used for these photographs: 35 mm pre and post test photographs taken at 90° and 45° angles of the restraint as installed on the standard bench, vehicle shell or vehicle. The restraint shall be photographed with no dummy in the seat for the configuration photo and each label on the restraint shall also be photographed.

FILM/VIDEO DOCUMENTATION

At the very beginning, and for each separate segment, film/video identification placards or slates covering the following description of the film/video:

- A. Project title
- B. Test number where appropriate
- C. Date filmed/videoed
- D. Type of test or product being filmed/videoed
- E. Conditions of test or product being filmed/videoed

FILM/VIDEO PRESERVATION AND IDENTIFICATION

- A. The film/video actually shot in the camera/VCR (the original) should never be screened. After the original is developed, add an identifying leader to the beginning of the film/video (the head) with the following information on it:
 - (1) Project title
 - (2) Inclusive test numbers where appropriate
 - (3) The name of the filming/videoing organization
 - (4) Date
 - (5) The word "ORIGINAL"
- B. Make high quality duplicate of the original film/video (for film, a B-wind optical duplicate master, liquid gate) as a protection copy in case the original is lost or damaged. Make a work-print from the original to be used for editing. Affix identifying leaders to the heads of both the B-wind master and work-print as described in 8.2.2 (1) above.

9. PHOTOGRAPHIC DOCUMENTATION....Continued

- C. Store the video and copy or the original film and B-wind master on cores, heads out, in plastic bags, and the bags in dust-proof cans or containers. Label storage containers with the same information as on the leaders, plus a notation of the length (time and feet), color or black and white, and silent or sound (magnetic or optical). Store containers in climate controlled vaults.

FILM/VIDEO EDITING

Edit the work-print to remove extraneous material.

FILMS/VIDEOS FOR CIRCULATION

Reproduce prints for distribution (release prints) from the original film/video based on the final edited work-print.

FILM/VIDEO ABSTRACT

Prepare an abstract or description of the film's/video's content to accompany the film/video when it is delivered to NHTSA.

DISPOSITION OF FILMS/VIDEOS

- A. For the purpose of duplicating prints for NHTSA and outside sources, the contractor shall retain the original and video copy or B-wind master until NHTSA requests that they be delivered to NHTSA.
- B. In addition to the number of prints required by the contracting Officer's Technical Representative, the contractor shall provide one (1) print to the NHTSA Office of Vehicle Safety Compliance (OVSC), along with a copy of the abstract or description.

COMPONENT TEST

Each final test report shall include color photographs of the test item as received by the COTR. Include a label with the name and model of test item, and the test numbers where appropriate. Include color photographs of testing equipment.

10. DEFINITIONS

ADD-ON CHILD RESTRAINT SYSTEM

Any portable child restraint system.

BACKLESS CHILD RESTRAINT SYSTEM

A child restraint other than a belt-positioning seat, that consists of a seating platform that does not extend up to provide a cushion for the child's back or head and has a structural element designed to restrain forward motion of the child's torso in a forward impact.

BELT-POSITIONING SEAT

A child restraint system that positions a child on a vehicle seat to improve the fit of a vehicle Type II belt system on the child and that lacks any component, such as a belt system or a structural element, designed to restrain forward movement of the child's torso in a forward impact.

BOOSTER SEAT

A child restraint that is either a backless child restraint system or a belt-positioning seat.

BUILT-IN CHILD RESTRAINT SYSTEM

Any child restraint system that is designed to be an integral part of and permanently installed in a motor vehicle.

CAR BED

A child restraint system designed to restrain or position a child in the supine or prone position on a continuous flat surface.

CHILD RESTRAINT SYSTEM

Any device, except Type I or Type II seat belts, designed for use in a motor vehicle or aircraft to restrain, seat, or position children who weigh 23 kg (50 pounds) or less.

CONTACTABLE SURFACE

Any child restraint system surface (other than that of a belt, belt buckle, or belt adjustment hardware) that may contact any part of the head or torso of the appropriate test dummy, specified in S7, when a child restraint system is tested in accordance with S6.1 of FMVSS 213.

10. DEFINITIONS....Continued

FACTORY INSTALLED BUILT-IN CHILD RESTRAINT

A built-in child restraint system that has been or will be permanently installed in a motor vehicle before that vehicle is certified as a completed or altered vehicle in accordance with part 567 of 49 CFR Chapter 5, certification requirements for passenger vehicles.

REAR-FACING CHILD RESTRAINT

A child restraint system, except a car bed, that positions a child to face in the direction opposite to the normal direction of travel of the motor vehicle.

REPRESENTATIVE AIRCRAFT PASSENGER SEAT

Either a Federal Aviation Administration approved production aircraft passenger seat or a simulated aircraft passenger seat conforming to Figure 24 (page 74) of this OVSC Laboratory Test Procedure.

SEAT ORIENTATION REFERENCE LINE (SORL)

The horizontal line through Point Z as illustrated in Figure 15 (page 47) of this OVSC Laboratory Test Procedure.

SPECIFIC VEHICLE SHELL

The actual vehicle model part into which the built-in child restraint system is or is intended to be fabricated, including the complete surroundings of the built-in system. If the built-in child restraint system is or is intended to be fabricated as part of any seat other than a front seat, these surroundings include the back of the seat in front, the interior rear side door panels and trim, the floor pan, adjacent pillars (e.g., the B and C pillars), and the ceiling. If the built-in system is or is intended to be fabricated as part of the front seat, these surroundings include the dashboard, the steering mechanism and its associated trim hardware, any levers and knobs installed on the floor or on a console, the interior front side door panels and trim, the front seat, the floor pan, the A pillars and the ceiling.

TORSO

The portion of the body of a seated anthropomorphic test dummy, excluding the thighs, that lies between the top of the child restraint system seating surface and the top of the shoulders of the test dummy.

11. PRETEST REQUIREMENTS

OPERATING TEST PROCEDURE

Prior to conducting any compliance test, contractors are required to submit a detailed in-house compliance test procedure to the COTR, which includes a step-by-step description of the methodology to be used. Written approval must be obtained from the COTR before initiating the compliance test program so that all parties are in agreement.

TEST DATA LOSS

A compliance test is not to be conducted unless all of the various test conditions specified in the applicable OVSC Laboratory Test Procedure have been met. Failure of a contractor to obtain the required test data and to maintain acceptable limits on test parameters in the manner outlined in the applicable OVSC Laboratory Test Procedure may require a retest at the expense of the contractor. The retest costs will include the cost of the replacement item of motor vehicle equipment and all costs associated with conducting the retest. The original test specimen used for the invalid test shall remain the property of OVSC, and the retest specimen shall remain the property of the contractor. If there is a test failure, the contractor shall retain the retest specimen for a period not exceeding two years. If there is no test failure, the Contractor may dispose of the test specimen upon notification from the COTR that the final test report has been accepted.

The Contracting Officer of NHTSA is the only NHTSA official authorized to notify the contractor that a retest is required. The retest shall be completed within two (2) weeks after receipt of notification by the Contracting Officer that a retest is required. If a retest is conducted, no test report is required for the original test.

GENERAL TEST CONDITIONS

Unless otherwise specified, all tests and measurements shall be conducted under the following environmental conditions:

Temperature	19°C (66°F) to 26°C (78°F)
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Relative Humidity	10% to 70%
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The laboratory shall be capable of setting, controlling, and reading the environmental condition parameters so that when the accuracies of the instrumentation and the systems are considered in evaluating the recorded data the results are within the upper and lower limits of the specifications.

Continuous recording of environmental conditions shall be provided for during all phases of testing.

11. PRETEST REQUIREMENTS....Continued

TEST PERSONNEL PERFORMANCE

Technicians charged with the responsibility of performing the compliance test program shall be thoroughly familiar with the requirements and test conditions for each test phase to be performed. Each technician shall be specifically instructed in the proper operation of all equipment employed in conducting these tests.

Personnel supervising the compliance test program shall be thoroughly familiar with the requirements, test conditions, and equipment for the test to be conducted.

12. COMPLIANCE TEST EXECUTION

A. TEST SAMPLES

A.1 MATERIALS TESTS

Samples of all materials used in a given child restraint system shall be supplied by NHTSA in appropriate quantities for the materials tests in this procedure and outlined in Figure 2.

(1) FLAMMABILITY TESTS

One (1) sample of each direction as applicable (longitudinal and lateral), 102 mm (4 inches) wide by 356 mm (14 inches) long, or the maximum available width or length if less, of each nonmetallic material is required for the flammability tests outlined in Figure 3. The laboratory may be required to cut specimens from an actual child restraint system.

(2) WEBBING PERFORMANCE TESTS

Twenty-four (24) samples, each 1,067 mm (42 inches) long, of each type of webbing used on the child restraint system are required for the webbing performance tests outlined in Figure 4.

(3) BELT BUCKLE AND ADJUSTMENT HARDWARE PERFORMANCE TESTS

Three (3) sets of all buckle and adjustment hardware and an additional three sets of any plastic or nonmetallic buckle and adjustment hardware are required for the hardware performance tests outlined in Figure 5.

(4) ENERGY ABSORBING MATERIALS PERFORMANCE TESTS

One (1) complete set of material is required for the energy absorbing materials performance tests outlined in Figure 6. Additional larger samples may be required for certain types of materials.

A.2 INSPECTION OF PHYSICAL FEATURES

One child restraint system shall be supplied by NHTSA for the inspection of physical features outlined in Figure 7.

12. COMPLIANCE TEST EXECUTION....Continued

A.3 DYNAMIC IMPACT TESTS

Child restraint systems shall be supplied by NHTSA for the dynamic impact tests outlined in Figure 8.

(1) DYNAMIC IMPACT TEST CONFIGURATION I

One (1) child restraint system is required for EACH TEST according to Dynamic Impact Test Configuration I. One or more tests are possible depending on the number of installation modes (forward facing/infant mode), adjustment positions (upright/recline), and height and weight recommendations of the manufacturer.

(2) DYNAMIC IMPACT TEST CONFIGURATION II

One (1) child restraint system is required for EACH TEST according to Dynamic Impact Test Configuration II. One or more tests are possible for each forward-facing system, other than a child harness, that is equipped with an anchorage belt or a fixed or movable surface directly forward of the dummy, in EACH ADJUSTMENT POSITION (i.e. upright or reclined) recommended by the manufacturer for actual use. Child restraint systems having both of the above features shall be tested with each feature “misused”, i.e., with the tether or restraint belts not attached, both separately and simultaneously. For each child restraint model, one or more tests are possible depending on the number of installation modes (forward facing/infant mode), adjustment positions (upright/recline), and height and weight recommendations of the manufacturer.

(3) RETEST

One (1) child restraint system shall be available as a spare unit in the event that a retest is required.

A.4 FAA INVERSION TEST

One (1) child restraint is required for each FAA test performed. For each child restraint model, one or more tests are possible depending on the number of installation modes (forward/reverse), adjustment positions (upright/recline), and height and weight recommendations of the manufacturer.

12. COMPLIANCE TEST EXECUTION....Continued

A.5 TEST SAMPLE INSPECTION, INVENTORY, IDENTIFICATION AND STORAGE

All child restraint systems and associated extra materials and parts shall be stored upon receipt in a clean, dry, secure storage area to prevent any damage or deterioration that might affect test results. Within one week of receipt, all samples shall be inspected, and the date of receipt and condition of the samples shall be recorded. Each sample shall also be marked or labeled with a systematic item-coding scheme to indicate the following:

1. Sequential number for entire sample set
2. Child restraint manufacturer and model
3. Sequential sample number within set
4. Type of test to be conducted with sample

EXAMPLE: 001-XYZ-03-MW

This item code shall be recorded on all Data Sheets applicable to the test sample.

A.6 TEST DATA

Test data shall be recorded in standard engineering units, when applicable, on Data Sheets specifically prepared for this purpose, as shown in section 15 of this procedure.

For each FMVSS requirement indicated on the Data Sheets, determine compliance, and record PASS, FAIL, NA (not applicable), or SEE REMARKS in the space provided. Any noncompliance should be explained under REMARKS.

The full set of Data Sheets shall be included in the Final Test Report.

B. MATERIALS TESTS

B.1 FLAMMABILITY TEST (S213, S5.7; S302, S4.1, S4.2))

B.1.1 GENERAL

All nonmetallic materials of a child restraint system shall meet the flammability requirements of S302 as outlined in this procedure. Any material that does not adhere to other material(s) at every point of contact shall meet the given requirements when tested separately. Any material that adheres to other

12. COMPLIANCE TEST EXECUTION....Continued

material(s) at every point of contact shall meet these same requirements when tested as a composite with the other materials. Indicate on the appropriate Data Sheets the type of material being tested and the specimen's function on the restraint system (i.e., padding, buckle, shell, etc.).

B.1.2 ENVIRONMENTAL CONDITIONS (S302, S5.1.2)

Flammability tests shall be conducted under the following environmental conditions:

Temperature 16°C (60°F) to 27°C (80°F)

Relative Humidity 40% to 60%

Each specimen shall be conditioned for a minimum of 24 hours under these environmental conditions before subjecting it to the flammability test.

B.1.3 EQUIPMENT REQUIREMENTS (S302, S5.1.1)

Conduct the test in a metal cabinet for protecting the test specimens from drafts, as shown in Figure 10 below. The interior of the cabinet is 381 mm (15 inches) long, 203 mm (8 inches) deep, and 356 mm (14 inches) high. It has a glass observation window in the front, a closable opening to permit insertion of the specimen holder, and a hole to accommodate tubing for a gas burner. For ventilation, it has a 13 mm (0.50 inch) clearance space around the top of the cabinet, ten (10) 19 mm (0.75 inch) diameter holes in the base of the cabinet, and legs to elevate the bottom of the cabinet by 10 mm (0.375 inch), all located as shown in the figure. If tested in exhaust hood, the maximum allowable airflow is 55CFM as measured at intake with sash opening of 127 mm (5 inches).

SPECIMEN SUPPORT FRAME (S302, S5.1.3)

Insert the test specimen between two matching U-shaped frames of metal stock 25 mm (1 inch) wide and 10 mm (0.375 inch) high. The interior dimensions of the U-shaped frames are 51 mm (2 inches) wide by 330 mm (13 inches) long. A specimen that softens and bends at the flaming end so as to cause erratic burning is kept horizontal by supports consisting of thin, heat resistant wires, spanning the width of the U-shaped frame under the specimen at 25 mm (1 inch) intervals. A device that may be used for supporting this type of material is an additional U-shaped frame, wider than the U-shaped frame containing the specimen, spanned by 10 mil wires of heat-resistant composition at 25 mm (1 inch) intervals, inserted over the bottom U-shaped frame.

12. COMPLIANCE TEST EXECUTION....Continued

FLAME SOURCE (S302, S5.1.4 and S5.1.5)

Use a Bunsen burner with a tube of 10 mm (0.375 inch) inside diameter. Set the gas-adjusting valve to provide a flame, with the tube vertical, of 38 mm (1.50 inches) \pm 2 mm (0.0625 inch) in height. Close the air inlet to the burner. The gas supplied to the burner should have a flame temperature equivalent to that of natural gas.

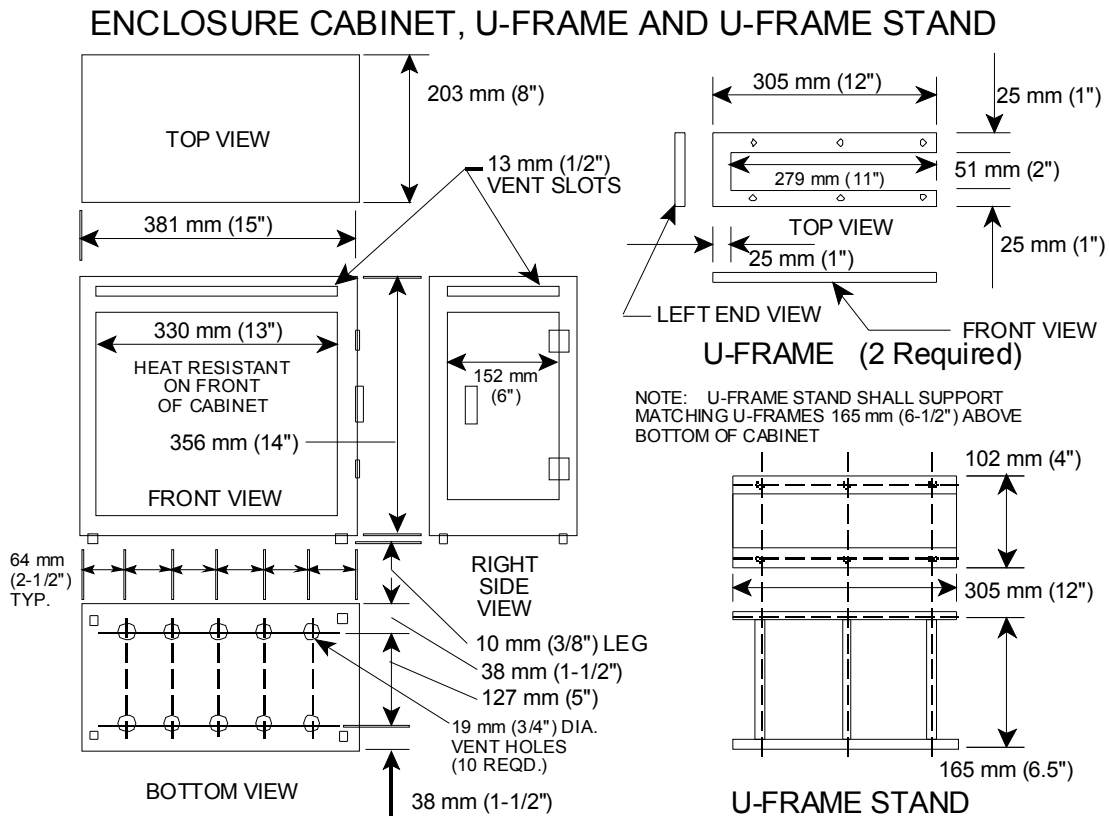


FIGURE 10

B.1.4 SPECIMEN PREPARATION (S302, S5.2.1, S5.2.2, S5.2.3)

Each specimen of material to be tested shall be a rectangle 102 mm (4 inches) wide by 356 mm (14 inches) long, whenever possible. The thickness of the specimen is that of the single or composite material used in the child restraint system, except that if the material's thickness exceeds 13 mm (0.5 inch), cut the specimen down to that thickness. When it is not possible to obtain a flat specimen because of surface curvature, cut the specimen to not more than 13 mm (0.5 inch) in thickness at any point. Use the maximum available length or width of a specimen when either dimension is less than 356 mm (14 inches) or 102 mm (4 inches), respectively. For homogeneous material, prepare a single

12. COMPLIANCE TEST EXECUTION....Continued

specimen. For material with directional structure, cut and test two specimens, one oriented parallel to and the other oriented perpendicular to this structure. If during a test, a diagonal direction appears to yield a more adverse result, prepare and test a third specimen oriented diagonally. Place material with a napped or tufted surface on a flat surface and comb twice against the nap with a comb having 7 to 8 smooth, rounded teeth per 25 mm (1 inch).

B.1.5 TEST PROCEDURE (S302, S5.3)

Orient the specimen so that the surface closest to the child restraint occupant faces downward on the test frame. Mount the specimen so that both sides and one end are held by the U-shaped frame, and one end is even with the open end of the frame. When the maximum available width of a specimen is not more than 51 mm (2 inches), so that the sides of the specimen cannot be held in the U-shaped frame, place the specimen in position on wire supports with one end held by the closed end of the U-shaped frame.

Place the mounted specimen in a horizontal position, in the center of the cabinet. With the flame properly adjusted, position the Bunsen burner and specimen so that the center of the burner tip is 19 mm (0.75 inch) below the center of the bottom edge of the open end of the specimen. Expose the specimen to the flame for 15 seconds, +0, -1 second. Turn off the gas supply to the burner and reset the timer to zero.

Begin timing (without reference to the period of application of the burner flame) when the flame from the burning specimen reaches a point 38 mm (1.50 inches) \pm 2 mm (0.0625 inch) from the open end of the specimen. Use the forward-most point of visible flame as a reference point. Measure the time that it takes the flame to progress to a point 38 mm (1.50 inches) from the clamped end of the specimen. If the flame does not reach the specified end point, time its progress to the point where flaming stops.

Calculate the burn rate from the following formula:

$B = 60 \times D/T$, where —

B = burn rate in millimeters (inches) per minute

D = length the flame travels in millimeters (inches)

T = time in seconds for the flame to travel D millimeters (inches)

Record the burn rate data on the appropriate Data Sheet along with any observations on burn characteristics.

12. COMPLIANCE TEST EXECUTION....Continued

B.1.6 PERFORMANCE REQUIREMENTS (S302, S4.3)

When tested in accordance with the appropriate section of this procedure, the material shall not burn, nor transmit a flame front across its surface, at a rate of more than 102 mm per minute (mpm)(4 inches per minute(ipm)). However, the requirement concerning transmission of a flame front shall not apply to a surface created by the cutting of a test specimen for purposes of testing.

If a material stops burning before it has burned for 60 seconds from the start of timing, and has not burned more than 51 mm (2 inches) from the point where timing was started, it shall be considered to meet the burn-rate requirement.

In the case of a noncompliance, repeat burn test on a fresh specimen using support wires and exhaust hood off (or minimum airflow to remove smoke). Record repeat results in remarks section of appropriate Data Sheet.

Record the results on the appropriate Data Sheet.

B.2 WEBBING PERFORMANCE TESTS (S213, S5.4.1)

This section applies to the webbing of belts provided with a child restraint system and used to attach the system to the vehicle or to restrain the child within the system. Three specimens of each type of webbing are to be subjected to each of the following webbing performance tests. Eighteen (18) belt-webbing specimens, 1,067 mm (42 inches) of each type of webbing used in the child restraint system are required to determine compliance.

B.2.1 ENVIRONMENTAL CONDITIONING (S209, S5.1(a))

When specified below for particular tests, webbing samples shall be conditioned for at least 24 hours under the following environmental conditions:

Temperature	21°C (69.8°F) to 25°C (77°F)
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Relative Humidity	48% to 67%
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B.2.2 BREAKING STRENGTH (S213, S5.4.1(a); S209, S5.1(b))

Subject three specimens of each type of belt webbing used in the child restraint system to the environmental conditioning.

Test the webbing for breaking strength in a testing machine having a load-generating capacity of approximately 2,268 kg (5,000 pounds) and verified to have an error of not more than 1 percent in the range of the breaking strength of

12. COMPLIANCE TEST EXECUTION....Continued

the tested webbing by ASTM E4-79, Standard Methods of Load Verification of Testing Machines. The machine shall be equipped with split drum grips illustrated in Figure 11, shown on the next page, having a diameter between 51 mm (2 inches) and 102 mm (4 inches). The rate of grip separation shall be between 51 mm (2 inches) and 102 mm (4 inches) per minute. The distance between the centers of the grips at the start of the test shall be between 102 mm (4 inches) and 254 mm (10 inches). After placing the specimen in the grips, stretch the webbing continuously at a uniform rate to failure. Record the breaking strength for each specimen on the appropriate Data Sheet, and calculate a median breaking strength to be used as a baseline for comparison with the results of other tests.

B.2.3 RESISTANCE TO ABRASION (S209, S5.1(d))

Test three specimens for resistance to abrasion by rubbing over the hexagon bar illustrated in Figure 12, in the following manner. Mount the webbing in the apparatus as shown schematically in the figure. Attach one end of the webbing (A) to a weight (B) which has a mass of 1.5 kg (3.3 pounds) \pm 0.05 kg (0.1 pound), except that a mass of 2.36 kg (5.2 pounds) \pm 0.05 kg (0.1 pound) shall be used for webbing in an anchorage belt (tether) provided with the child restraint system. Pass the webbing over the two new abrading edges of the hexagon bar (C), and attach the other end to an oscillating drum (D) that has a stroke of 330 mm (13 inches). Use suitable guides to prevent movement of the webbing along the axis of hexagonal bar C. Oscillate drum D for 5,000 strokes or 2,500 cycles at a rate of 60 strokes \pm 2 strokes per minute or 30 cycles \pm 1 cycle per minute.

Upon completion of the webbing abrasion, conduct a breaking strength test on the three belt webbing specimens as outlined in this procedure, including the required environmental conditioning. Record the breaking strength for each abraded specimen on the appropriate Data Sheet, calculate the median breaking strength for the three specimens, and record this value on the Data Sheet. The median breaking strength of the abraded samples shall be at least 75% of the median breaking strength of the non-abraded belt webbing specimens of the same type.

12. COMPLIANCE TEST EXECUTION....Continued

BREAKING STRENGTH TEST DEVICE

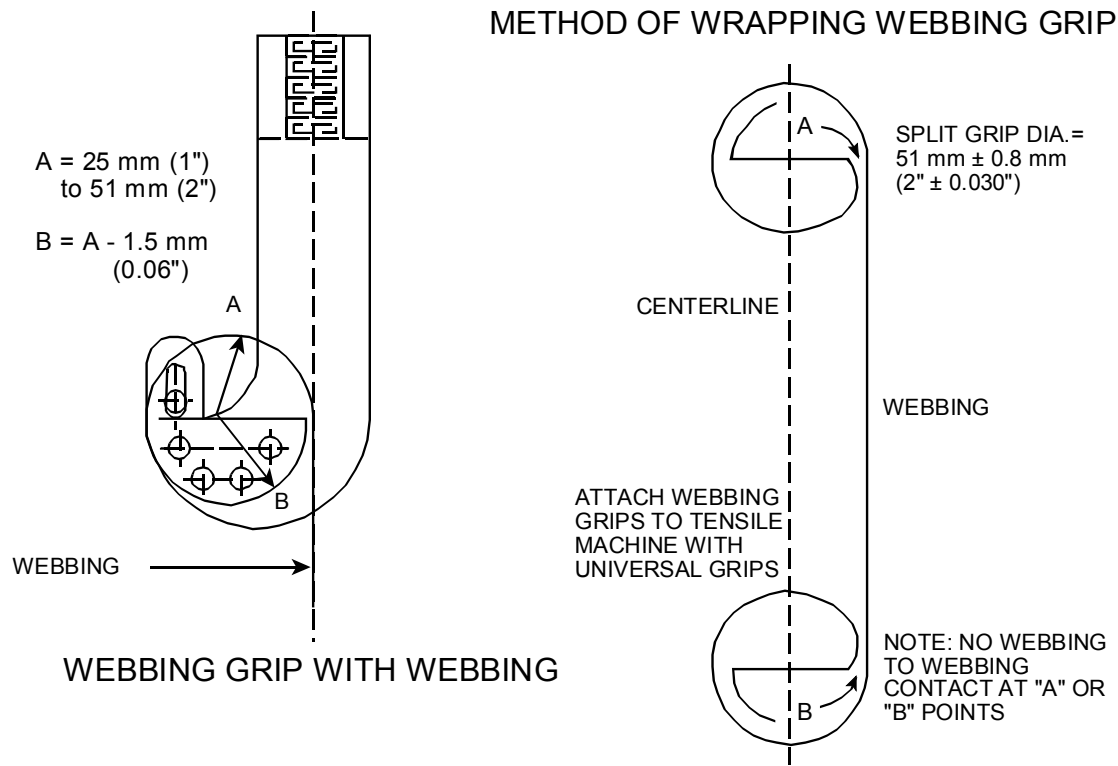


Figure 11

ABRASION TEST SCHEMATIC

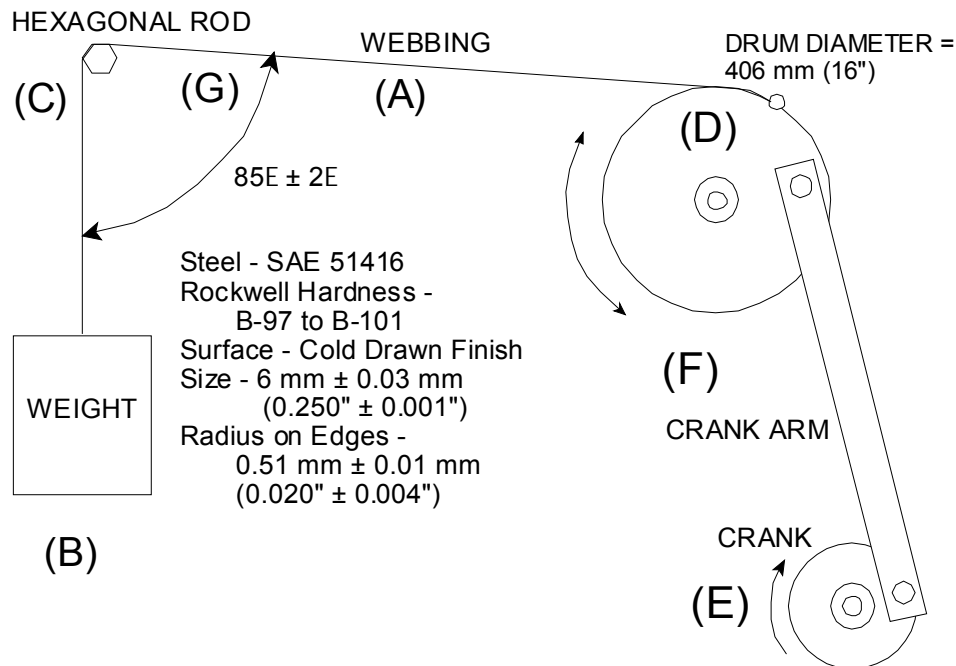


FIGURE 12

12. COMPLIANCE TEST EXECUTION....Continued

B.2.4 RESISTANCE TO BUCKLE ABRASION (S209, S5.3(c))

Test three specimens of each type of belt webbing used in a child restraint system for resistance to abrasion by each buckle or manual adjusting device normally used to adjust the size of the assembly. Expose the webbing for 4 hours, + 0 minutes, - 5 minutes, to an atmosphere having relative humidity of 65 percent, ± 5 percent, and temperature of 21°C (70°F), $\pm 3^{\circ}\text{C}$ (5°F). Pull the webbing back and forth through the buckle or manual adjusting device as shown schematically in Figure 13. Attach the anchor end of the webbing (A) to a weight (B) or 1.4 kg (3 pounds). Pass the webbing through the buckle (C), and attach the other end (D) to a reciprocating device so that the webbing forms an angle of 8° , $+4^{\circ}$, -0° with the hinge stop (E). Operate the reciprocating device for 2,500 cycles at a rate of 18 cycles per minute with a stroke length of 203 mm (8 inches) $+0$, -12.7 mm ($+0$, $-.5$ inches). Upon completion of the webbing buckle abrasion, conduct a breaking strength test on the three belt webbing specimens as outlined in this procedure, including the required environmental conditioning. Record the breaking strength for each buckle-abraded specimen on the appropriate Data Sheet, calculate the median breaking strength for the three specimens, and record this value on the Data Sheet. The median breaking strength of the buckle-abraded samples shall be at least 75% of the median breaking strength of the non-abraded belt webbing specimens of the same type.

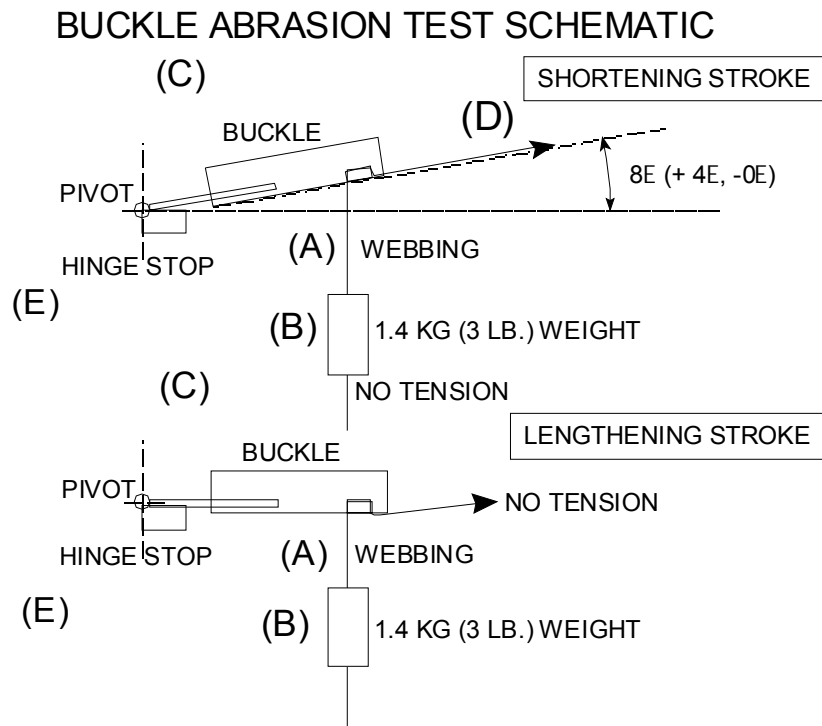


FIGURE 13

12. COMPLIANCE TEST EXECUTION....Continued

B.2.5 RESISTANCE TO LIGHT (S209, S4.2(e), S5.1(e))

Test three specimens of each type of belt webbing used in the child restraint system for resistance to light. Webbing specimens shall be at least 508 mm (20 inches) in length. Suspend these specimens vertically on the inside of the specimen rack in a Type E carbon-arc light-exposure apparatus described in ASTM G23-81, Standard Practice for Operating Light-Exposure Apparatus (Carbon-Arc Type) With and Without Water for Exposure of Nonmetallic Materials. Operate the apparatus without water spray at an air temperature of 60°C (140°F) \pm 2°C (3.6°F) measured at a point 25 mm (1.0 inch) \pm 5 mm (0.2 inch) outside the specimen rack and midway in height. The temperature-sensing element shall be shielded from radiation. Use cortex filter for nylon and soda-lime filter for polyester webbing.

Expose the specimens to the light from the carbon arc for 100 hours, + 0 hours, - 0.5 hours, and then condition the specimens under the environmental conditions given in this procedure.

Determine the Color fastness of the exposed and conditioned specimens on the AATCC Geometric Gray Scale. The webbing shall have a color retention not less than No. 2 on this scale. Record the results for each specimen on the appropriate Data Sheet.

Conduct a breaking strength test on the three light-exposed and conditioned belt-webbing specimens as outlined in this procedure without repeating the environmental conditioning. Record the breaking strength of each carbon-arc-exposed belt webbing specimen on the appropriate Data Sheet, calculate the median breaking strength for the three specimens, and record this value on the Data Sheet. The median breaking strength of the carbon-arc-exposed samples shall be at least 60% of the median breaking strength of specimens of the same type of belt webbing without any exposure to the carbon arc.

B.2.6 RESISTANCE TO MICRO-ORGANISMS (S209, S4.2(f), S5.1(f))

Test three specimens of each type of belt webbing used in the child restraint system for resistance to micro-organisms, unless the webbing is made from material inherently resistant to micro-organisms. Webbing specimens shall be at least 508 mm (20 inches) in length. Subject these specimens successively to the procedures prescribed in AATCC Test Method 30-81, Fungicides, Evaluation of Textiles; Mildew and Rot Resistance of Textiles, Section 1B3 -- Soil Burial Leaching, Section 1C2 -- Volatilization, and Section 1B3 -- Soil Burial Test. After soil-burial for a period of 2 weeks, wash the specimens in water, allow them to dry and condition them under the environmental conditions given in this procedure.

12. COMPLIANCE TEST EXECUTION....Continued

Upon completion of exposure to micro-organisms, conduct a breaking strength test on the three belt webbing specimens as outlined in this procedure, without repeating the environmental conditioning. Record the breaking strength of each micro-organism-exposed belt webbing specimen on the appropriate Data Sheet, calculate the median breaking strength for the three specimens, and record this value on the Data Sheet. The median breaking strength of the micro-organism-exposed samples shall be at least 85% of the median breaking strength of specimens of the same type of belt webbing without any exposure to micro-organisms

B.2.7 WIDTH (S213, S5.4.1(C), S5.4.1.1)

Subject three specimens of each type of belt webbing used in a child restraint system and contactable by the test dummy torso during the Dynamic Impact Test to width measurement. Condition the webbing for 24 hours under the following environmental conditions:

Temperature 21°C (70°F) to 25°C (77°F)

Relative Humidity 48% to 67%

Measure belt webbing width under a tension of 2 kg (5 pounds) applied lengthwise. The measured width of the belt webbing shall not be less than 38 mm (1.50 inches). Record the results for each specimen on the appropriate Data Sheet.

B.3 BELT BUCKLE AND ADJUSTMENT HARDWARE PERFORMANCE TESTS (S213, S5.4.2)

NOTE: See B.3.6, BUCKLE LATCH/PARTIAL ENGAGEMENT, prior to B.3.1, CORROSION RESISTANCE, and B.3.2, TEMPERATURE RESISTANCE.

B.3.1 CORROSION RESISTANCE (S209, S4.3(a), (2), S5.2(a))

Subject three specimens of all buckle and adjustment hardware to the salt spray test, according to ASTM B117-73, for a period not to exceed 25 hours, consisting of 24 hours, + 0, - 0.25 hour of salt spray exposure followed by 1 hour, + 0, - 0.1 hour of drying. Each specimen among a set of three should be oriented differently in the salt spray chamber. During the test, the temperature in the salt spray chamber shall be continuously and permanently recorded, and the test condition records specified in ASTM B117-73, section 13, shall be maintained.

After the test, wash the hardware thoroughly with water to remove the salt, and allow the specimens to dry for 24 hours under standard laboratory environmental

12. COMPLIANCE TEST EXECUTION....Continued

conditions as given in this procedure. Follow steps 1-4 to wash thoroughly:

- (1) Place component under running water 38°C (100°F) maximum.
- (2) Thoroughly wash while holding under running water. Rub component with fingers to remove salt.
- (3) Flip component over and repeat step #2.
- (4) After thoroughly washing, allow to dry for 24 hours before evaluation.

The hardware shall be free of ferrous or nonferrous corrosion that may be transferred, either directly or indirectly by means of webbing, to the restraint system's occupant or his/her clothing. Examine the hardware for such corrosion, and record the results on the appropriate Data Sheet.

B.3.2 TEMPERATURE RESISTANCE (S209, S4.3(b), S5.2(b))

Subject three new specimens of all plastic or other nonmetallic buckle and adjustment hardware to the accelerated service conditions test in accordance with ASTM D756-78, Procedure IV, omitting the weight and dimension measurements. Unlatch buckles, and condition the specimens as indicated in ASTM D756-78, Section 5, prior to and at the end of the test.

The hardware specimens shall not warp or otherwise deteriorate to cause the buckle or other assembly to operate improperly. Examine the specimens for such deterioration, and record the results on the appropriate Data Sheet.

The three hardware specimens used in this test shall also be tested according to applicable hardware tests outlined in this procedure.

B.3.3 BUCKLE RELEASE ACCESS (S209, S4.3(d)(2), S5.2(d))

Follow the procedure given below for the appropriate buckle design, and record the results on the appropriate Data Sheet.

PUSHBUTTON BUCKLES

Measure the linear dimensions of the surface designed for applying the release force, and calculate the area of this surface to the nearest 0.3 square cm (0.05 square inch). This surface shall have a minimum area of 4.5 square cm (0.7 square inch), with a minimum linear dimension of 10 mm (0.4 inch).

12. COMPLIANCE TEST EXECUTION....Continued

LEVER-RELEASE BUCKLES

Insert a cylinder 10 mm (0.4 inch) \pm 0.5 mm (0.02 inch) in diameter and 38 mm (1.5 inches) \pm 0.5 mm (0.02 inch) long in the actuation portion of the buckle release. The buckle shall permit insertion of this cylinder to at least the midpoint of the cylinder along the cylinder's entire length.

OTHER BUCKLE DESIGNS

Attempt to actuate the buckle release using two adult fingers. the buckle shall have adequate access for two or more fingers.

B.3.4 ADJUSTMENT FORCE (S209, S4.3(e), S5.2(e))

Test three sets of adjustment hardware and webbing for the force necessary to decrease the effective length of the assembly. The hardware previously used for the Corrosion Resistance of Temperature Resistance tests shall also be used for this test. With no load on the anchor end of the webbing, draw the webbing through the adjustment device at a rate of 508 mm per minute (mpm) (20 inches per minute (ipm)) \pm 50 mpm (2 ipm). Precycle the webbing 10 times in the above manner, and then measure the maximum force to the nearest 0.1 kg (0.25 pound) after the first 25 mm (1.0 inch) of webbing movement. The force required to decrease the effective length of this assembly shall not exceed 5 kg (11 pounds). Record the results on the appropriate Data Sheet.

B.3.5 TILT-LOCK ADJUSTMENT (S209, S4.3(f), S5.2(f))

If the adjustment device is of a "tilt-lock" design, test three such devices for lock angle. The hardware previously used for the Corrosion Resistance or Temperature Resistance tests shall also be used for this test. Orient the base of the adjustment mechanism and the anchor-end of the webbing in planes normal to each other. Draw the webbing through the adjustment mechanism in a direction to increase belt length at a rate of 508 mm (20 inches) \pm 50 mm (2 inches) per minute while the plane of the base is slowly rotated in a direction to lock the webbing. When the webbing locks, stop the rotation, but continue pulling on the webbing until there is a resistance of at least 9 kg (20 pounds). Measure the angle between the anchor-end of the webbing and the base of the adjustment mechanism to the nearest degree. The lock angle shall be not less than 30 degrees. Record the results on the appropriate Data Sheet.

B.3.6 BUCKLE LATCH/PARTIAL ENGAGEMENT (S209, S4.3(g), S5.2(g))

Six buckle/tongue assemblies are tested for "as received" partial engagement and then exposed as follows: three for Corrosion Resistance (B.3.1), and three

12. COMPLIANCE TEST EXECUTION....Continued

for Temperature Resistance (B.3.2). After exposure the assemblies are then tested for Buckle Latch and Partial Engagement.

NOTE: Self-ejecting buckles and buckles with plastic components in either tongue or latch mechanism are not evaluated for partial engagement. If it is possible to insert a tongue in the inverted position, both positions must be evaluated for partial engagement.

B.3.6.1 AS RECEIVED PARTIAL ENGAGEMENT

Anchor buckle in some manner. Attach tongue to a force gauge by a flexible means such that the alignment of buckle, tongue, and gauge can be made parallel. Manually insert tongue completely into buckle and withdraw only enough to induce partial engagement. Remove tongue from buckle with force gauge and record the highest force reading as the “partial engagement release force.” Perform three readings per assembly. The average of the three readings will be used to determine compliance. Repeat tests with tongue in inverted position as applicable.

Record the results on the appropriate Data Sheet.

B3.6.2 BUCKLE LATCH FOLLOWING CORROSION RESISTANCE (B.3.1) AND TEMPERATURE RESISTANCE (B.3.2)

Mount six buckles on a compressive cycling fixture. The fixture is such that one cycle will completely move a buckle’s release mechanism through its full range of motion and induce a force of 14 kg (30 lb) \pm 1 kg (2.2 lb) at the travel limit of the mechanism. Operate the fixture at a rate of 30 cpm for a total of 200 cycles. Visually and functionally evaluate buckle assemblies following cycling and then perform partial engagement.

B3.6.3 PARTIAL ENGAGEMENT

Manually latch and unlatch six buckle assemblies 20 times each. Perform partial engagement as per B.3.6.1. Record the results on the appropriate data sheet.

B.4 ENERGY ABSORBING MATERIALS PERFORMANCE TESTS (S213, S5.2.3, S6.3)

This section applies to material located in the head impact area of child restraint systems recommended for children weighing less than 9 kg (20 pounds). (See appropriate section of this procedure for the definition of head impact area). The specific test method depends on the type of base material used in the padding:

12. COMPLIANCE TEST EXECUTION....Continued

Sponge or expanded rubber:
ASTM D1056-73

Slab urethane foam:
ASTM D1564-71

Vinyl chloride polymers and copolymers (open-cell foam):
ASTM D1565-76

For materials which do not fall into the above three categories, analogous test procedures appropriate for the particular material should be used, identified, and recorded on the appropriate Data Sheet. If more than one type of material is used in the head impact area, each material shall be tested according to the procedures appropriate for that material.

B.4.1 COMPRESSION-DEFLECTION RESISTANCE (S213, S6.3.1)

Determine the base composition of the energy absorbing material, select the appropriate test procedures from the following sections, and measure the load necessary to produce a 25% deflection or indentation of the padding material. Record the base material type on the appropriate Data Sheet.

TEST APPARATUS

A material with a rubber base composition requires a compression testing machine (ASTM D1056-73, section 17) capable of compressing a test specimen at a rate of 13 to 51 mm (0.5 to 2 inches) per minute gently without impact. The machine may be motor or hand-driven and shall be equipped with a gage graduated in 0.0254 mm (0.001 inch) to measure deflection. The machine must also be capable of measuring the load produced by deflecting the specimen. The machine must have parallel metal loading plates 38 mm (1.5 inches), + 3 mm (0.1 inch), - 0 mm (0 inches) in diameter. For padding consisting of urethane base material or polyvinyl chloride polymer and copolymer base materials, a different test fixture in the compression testing machine is required as are different ranges of deflection speeds. For urethane base foams (ASTM D1564-71, section 20), the machine must be capable of deflecting the specimen at a speed of 25 to 381 mm (1.0 to 15 inches) per minute. For vinyl base foams (ASTM D1565-76, section 13), the machine must be capable of deflecting the specimen at a speed of 13 to 508 mm (0.5 to 20 inches) per minute. Both base material types require the same loading fixture which consists of a flat circular indenter foot, 323 ± 3.2 square cm (50 ± 0.5 square inches) in area, connected by means of a swivel joint to a load-measuring device and mounted in such a manner that the specimen can be deflected at the specified speeds. The apparatus shall be arranged to support the specimen on a level horizontal plate

12. COMPLIANCE TEST EXECUTION....Continued

that is perforated with 6 mm (0.24 inch) to 7 mm (0.26 inch) holes on 19 mm (0.75 inch) centers to allow for rapid escape of air during the test.

TEST SPECIMENS

Test specimens for rubber base materials shall be cylinders 29 mm (1.129 inches) \pm 2 mm (0.06 inch) in diameter, cut from the finished product, from standard test slabs, or from flat sheets (ASTM D1056-73, Figure 1). The specimen thickness shall be at least 6 mm (0.25 inch). Measure the thickness using a dial-type gage having a maximum stem and foot mass of 25 g and 337 mm (foot 1.25 inches) in diameter and exerting a pressure of 0.031 KPa \pm 0.0031 KPa (0.0045 psi \pm 0.00045 psi).

Test specimens for urethane base materials shall consist of the entire product sample or a portion of it. The specimen shall have dimensions not less than 381 mm (15 inches) by 381 mm (15 inches) by 19 mm (0.75 inches). Specimens less than 19 mm (0.75 inch) thick shall be made up of plies, without the use of cement, to a minimum thickness of 19 mm (0.75 inch). Measure the thickness of the specimens using dial-type gage with a minimum foot area of 6.5 square cm (1 square inch) exerting a pressure of 0.193 KPa \pm 0.048 KPa (0.028 psi \pm 0.007 psi).

The test specimens for vinyl base materials shall consist of a complete article or a portion thereof, with a surface for indentation not less than 305 mm (12 inches) by 305 mm (12 inches). If the thickness of the material is less than 25 mm (1 inch), the specimen shall be made up of plies to a minimum thickness of 25 mm (1 inch). Measure the thickness of the specimen with a dial gage graduated in divisions not larger than 0.0254 mm (0.001 inch). The gage shall have a circular foot between 6.5 square cm (1.0 square inches) and 9.7 square cm (1.5 square inches) in area exerting a pressure of 0.103 KPa \pm 0.010 KPa (0.0150 psi \pm 0.0015 psi).

ENVIRONMENTAL CONDITIONS

Test shall be conducted under the following environmental conditions:

Temperature	21°C (69.8°F) to 25°C (77°F)
Relative Humidity	45% to 55%

Condition the specimens for at least 12 hours under these conditions before testing.

12. COMPLIANCE TEST EXECUTION....Continued

TEST PROCEDURES

For rubber base materials, compress the standard test specimen between the parallel metal plates of the machine until the thickness has been reduced 25 percent, and take a reading of the load immediately. Repeat the test with the same specimen until the load readings do not change more than 5 percent.

For urethane base materials, place the specimen such that the indentation will be made at the center of the sample. Preflex the area to be tested by lowering the indenter foot twice to 75 to 80 percent of the full part thickness at a rate of 25 mm to 381 mm (1 to 15 inches) per minute. Mark the location of the test area with pen by circumscribing the indenter foot while under a 0.45 kg (1-pound) load. Allow the specimen to rest 6 minutes \pm 1 minutes after preflex. Bring the indenter foot into contact with the specimen and determine the thickness, after applying a preload of 0.45 kg (1 pound), of the area under the indenter foot. Compress the specimen 25 percent of this thickness at 51 mm (2 inches) per minute, and observe and record the final load in pounds after 1 minute.

For vinyl base materials place the specimen such that the indentation will be made at the center of the sample. Bring the indenter foot into contact with the specimen and determine the original height under a load of 0.45 kg (1 pound). Indent the specimen 25 percent of this original height. Maintain the deflection and record the load 1 minute after the 25 percent indentation is reached.

Normalize the load value determined in any of the above procedures by dividing it by the area of the loading surface. Record the resulting value in kilogram (pounds) per square cm (square inch) on the appropriate Data Sheet. The results of this test are used to determine compliance with the Head Impact Protection requirements outlined in this procedure.

C. INSPECTION OF PHYSICAL FEATURES

C.1 LABELING (S213, S5.5)

Inspect the labels attached to the child restraint system and compare them with the requirements of FMVSS 213, S5.5, listed on the appropriate Data Sheet. After the child restraint is installed, check whether certain required labels are visible in all recommended installation modes. Provide photographs of all labels on the child restraint system to show availability, legibility, and location. Include these photographs as part of the appropriate Data Sheet.

12. COMPLIANCE TEST EXECUTION....Continued

C.2 INSTALLATION INSTRUCTIONS (S213, S5.6)

Review the manufacturer's instructions for installation and use of the child restraint system to verify that they include the information specified by S213, S5.6, and listed on the appropriate Data Sheet. Verify that storage provisions are available for these instructions on the child restraint itself.

C.3 INSTALLATION (S213, S5.3)

The add-on child restraint shall have no means designed for attaching the system to the vehicle seat cushion or the vehicle seat back and no component (except belts) that is designed to be inserted between the vehicle seat cushion and vehicle seat back. Except for child harnesses and belt positioning seats, the add-on system shall also be capable of being restrained against forward movement solely by means of a Type I seat belt assembly (lap belt) or by means of a lap belt plus one additional anchorage strap (tether) that is supplied with the system. Each belt positioning seat shall be capable of being restrained against forward movement solely by means of a Type II seat belt assembly (lap and shoulder belt).

For car beds, the system shall be designed to be installed on a vehicle seat so that the car bed's longitudinal axis is perpendicular to a vertical longitudinal plane through the longitudinal axis of the vehicle. Indicate compliance and record any difficulties encountered during installation on the appropriate Data Sheet.

C.4 MINIMUM HEAD SUPPORT SURFACE (S213, S5.2.1)

This section does not apply to car beds or to forward-facing child restraints whose seating surface, when installed on the standard seat assembly, is low enough that the target point on either side of the appropriate dummy's head, when properly positioned in the restraint, is below the top of the standard seat assembly or vehicle seat (in the case of a built-in restraint). Indicate exemption, if appropriate, on the appropriate Data Sheet.

Other child restraint systems shall have a minimum back height, as specified below, based on the manufacturer's recommended maximum weight for children using the restraint:

MAXIMUM WEIGHT	BACK HEIGHT
Under 9 kg (20 pounds)	457 mm (18 inches)
9 kg (20) to 18 kg (40 pounds)	508 mm (20 inches)
Over 18 kg (40 pounds)	559 mm (22 inches)

12. COMPLIANCE TEST EXECUTION....Continued

Measure the height of the restraint back surface along the vertical centerline from the seating surface to the top of the back surface. The padding on the seating surface may be depressed by the weight of the appropriate dummy in the seated position. Record the results on the appropriate Data Sheet.

The width of the back surface, at the height specified above, shall be at least 203 mm (8 inches), or at least 152 mm (6 inches) if side wings at least 102 mm (4 inches) deep are also provided. Measure the depth of these side wings, if any, along a line perpendicular to the restraint back surface at the appropriate height from the seating surface as specified above. Record the results on the appropriate Data Sheet.

Measure the widest part of the back surface at the height specified above and at the forward plane made by the center of gravity targets located on each side of the dummy head of the appropriate size dummy when seated in the restraint as shown in Figure 14. However, the 6 year old child dummy is not used to determine applicability of or compliance with S5.2.1.1.

SEAT BACK WIDTH MEASUREMENT

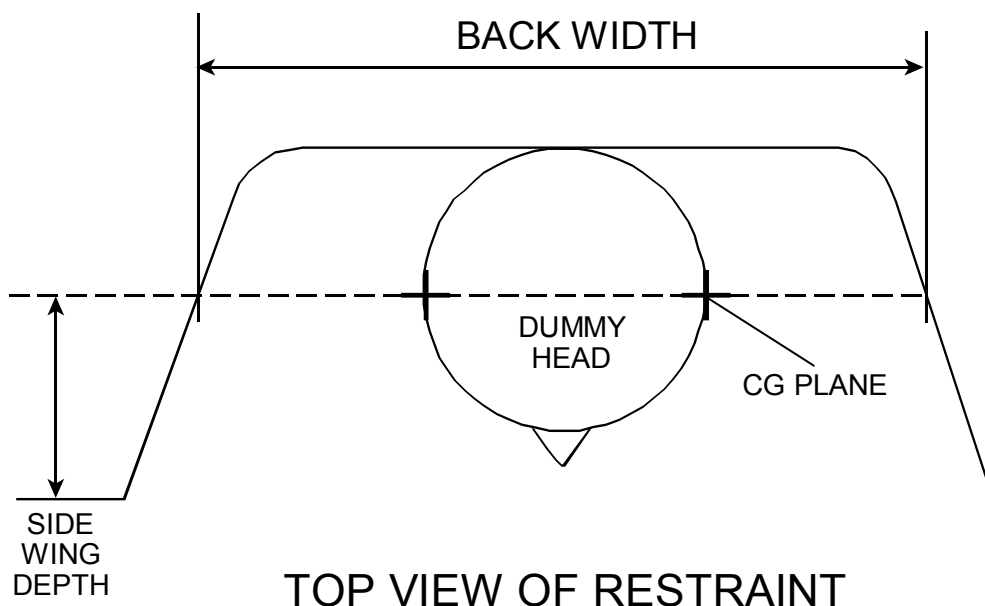


FIGURE 14

The side wing depth shall be the remaining wing material forward of the dummy head C_G plane.

In the case of a built-in child restraint, measure the height of the seat back as noted above. If the system includes a head rest also measure the seat height including the head rest in the fully down position. Record the results on the appropriate Data Sheet.

12. COMPLIANCE TEST EXECUTION....Continued

C.5 BELT RESTRAINT (S213, S5.4.3)

C.5.1 SNUG FIT OF BELTS (S213, S5.4.3.1)

Each belt that is designed to restrain a child using the system shall be adjustable to snugly fit any properly positioned child whose height and weight are within the ranges recommended by the manufacturer. Using the appropriate dummy, fasten and adjust the system's harness to fit properly around the dummy. If there is insufficient webbing to do so, the restraint system fails. If webbing is sufficient, note how much additional webbing is available to further lengthen and secure each harness segment. Record this information on the appropriate Data Sheet.

There is currently no test criterion for "snug fit" at the lower end of the size range. Questionable cases should be indicated, however, under **REMARKS** on the appropriate Data Sheet for evaluation by COTR.

C.5.2 DIRECT RESTRAINT BELTS (S213, S5.4.3.2)

Except for a child restraint system whose mass is less than 4.4 kg (9.7 pounds), no belt that is designed both to restrain the child and to attach the restraint to the vehicle shall impose a load on the dummy resulting from the mass of either the child restraint system or the back of the standard seat assembly (for an add-on child restraint) or any part of the vehicle (for a built-in child restraint) during the Dynamic Impact Test. In addition, each Type I and the lap portion of a Type II belt system that is used to attach the system to the vehicle seat shall impose no loads on the child that result from the mass of the system, or the mass of the seat back (in the case of add-on systems) or from the mass of any part of the vehicle into which the child restraint is built (for built-in systems). To determine compliance with this requirement, verify whether the following conditions are met:

- (1) The belt in question contacts the dummy for the purpose of restraint
- (2) the child restraint includes any rigid structure between the dummy and the back of the standard seat assembly
- (3) The child restraint can slip such that the belt in question contacts the dummy for the purpose of restraint

If ALL THREE conditions apply, the restraint FAILS. If any one condition is

NOT met, the restraint PASSES. Record the results on the appropriate Data Sheet.

12. COMPLIANCE TEST EXECUTION....Continued

C.5.3 SEATING SYSTEM BELTS AND/OR SHIELDS (S213, S5.4.3.3)

These requirements apply to child restraints that are designed for use by a child in a seated position and that include belt restraints, with the specific exception of child harnesses. Also excluded are infant restraint systems that are designed to place the child in a rear-facing, semi-recumbent position instead of a seated position, and that are recommended only for children up to 10 kg. (22 lb.). For applicable seating systems, the following restraining systems shall be provided:

(1) Upper torso

Either belts passing over each shoulder of the child or a fixed or movable surface that complies with S5.2.2.1(c).

(2) Lower torso

Either a lap belt (angle with seating surface at anchorage point to be between 45 degrees and 90 degrees) or a fixed or movable surface that complies with S5.2.2.1(c).

(3) Crotch restraint

For child restraints recommended for children over 10 kg (22 pounds), either a crotch belt connectable to the lower torso restraint or a fixed or movable surface that complies with S5.2.2.1(c). Verify the existence of the above systems, and record the results on the appropriate Data Sheet.

C.5.4 CHILD HARNESS BELTS (S213, S5.4.3.4)

For child harnesses, the following restraining belts shall be provided:

(1) Upper Torso -- Belts passing over each shoulder of the child

(2) Lower Torso -- Lap and crotch belts

(3) Belts to prevent any properly restrained child, whose height is within the range recommended by the manufacturer, from standing on the vehicle seat.

Verify the existence of the above belts, and record the results on the appropriate Data Sheet.

12. COMPLIANCE TEST EXECUTION....Continued

C.6 TORSO IMPACT PROTECTION (S213, S5.2.2)

These requirements do not apply to car beds. For other child restraint systems, the following surface area and curvature requirements apply. Remove padding for all curvature determinations, noting any difficulties on the appropriate Data Sheet.

For measurements that refer to dummy "shoulder height" or "torso depth," use the following dimensions for the appropriate dummy, based on the manufacturer's recommended maximum weight for children using the restraint. These values are only provided for reference purposes to permit a determination of compliance with S5.2.2.1 (a) and S5.2.2.1 (b):

MAXIMUM WEIGHT	DUMMY	SHOULDER HEIGHT	TORSO DEPTH
Under 10 kg (22 pounds)	9-month-old	280 mm (11.4 inches)	100 mm (4.1 inches)
10 kg (22 pounds) or more	3-year-old	368 mm (14.5 inches)	133 mm (5.25 inches)

C.6.1 BACK SUPPORT SURFACE (S213, S5.2.2.1(a))

The surface provided for the support of the child's back shall be flat or concave and have a continuous surface area of not less than 548 square cm (85 square inches). The area to be considered is the entire width of the restraint back surface below a height above the seating surface indicated above as "shoulder height" for the appropriate dummy. Measure this area, and record the results on the appropriate Data Sheet.

C.6.2 SIDE SUPPORT SURFACE (S213, S5.2.2.1(b))

Each surface provided for support of the side of the child's torso shall be flat or concave and have a continuous surface of not less than 155 square cm (24 square inches) for systems recommended for children weighing 9 kg (20 pounds) or more, or 310 square cm (48 square inches) for systems recommended for children weighing less than 9 kg (20 pounds). "Torso" is defined as "the portion of the body of a seated anthropomorphic test dummy, excluding the thighs that lie between the top of the child restraint system seating surface and the top of the shoulders of the test dummy." The area to be considered as:

- (1) **BELOW** a line perpendicular to the restraint back surface at a height above the seating surface indicated above as "shoulder height" for the appropriate dummy, and

12. COMPLIANCE TEST EXECUTION....Continued

- (2) **REARWARD** of a line perpendicular to the seating surface at a distance forward of the restraint back surface indicated above as "torso depth" for the appropriate dummy.

Measure this area, and record the results on the appropriate Data Sheet.

C.6.3 FORWARD RESTRAINING SURFACE (S213, S5.2.2.1(c))

Each horizontal cross section of each surface designed to restrain forward movement of the child's torso shall be flat or concave, and each vertical longitudinal cross section shall be flat or convex with a radius of curvature of the underlying structure of not less than 51 mm (2 inches). To determine contactable area of the forward restraining surface, the dummy may be "chalked" prior to the dynamic test and post test inspect the forward surface for transferred chalk. This surface shall be the contactable surface. Determine the curvatures, and record the results on the appropriate Data Sheet.

C.6.4 FORWARD FIXED OR MOVABLE SURFACES (S213, S5.2.2.2)

For forward-facing child restraint systems, there shall be no fixed or movable surface directly in front of the appropriate test dummy, when properly positioned in the restraint, and intersected by a horizontal line parallel to the Seat Orientation Reference Line (SORL) and passing through any portion of that dummy, except for surfaces that restrain the dummy when tested according to Dynamic Impact Test Configuration II (S213, S6.1.2(a)2). If such a surface exists, determination of compliance must be deferred pending results of the Dynamic Impact Test. If no such surface exists, the system complies. Indicate PASS or DEFERRED on the appropriate Data Sheet.

C.7 HEAD IMPACT PROTECTION (S213, S5.2.3)

For child restraint systems recommended for children weighing less than 10 kg (22 pounds), with the exception of child harnesses, each surface that is contactable by the dummy head during the Dynamic Impact Test shall be covered with slow recovery, energy absorbing material with a 25% compression-deflection resistance of 0.2 kg (0.5 pound) to 4.5 kg (10 pounds) per square inch (psi). Unpadded protrusions that meet the requirements defined in S5.2.4 are exempt from the Head Impact Protection requirement.

For rear-facing infant restraints, the head impact area is any surface directly forward or rearward of the dummy and above its shoulders. For car beds or other laterally-positioned restraints, the head impact area includes any surface forward, rearward, or to either side of the dummy's head and above its shoulders. For a car bed that does not have positioning devices within the

12. COMPLIANCE TEST EXECUTION....Continued

restraint, the entire interior surface should be included. If films of the Dynamic Impact Test disclose that surface not expected to be within the head impact area are being impacted by the dummy head, make a notation under **REMARKS** on the appropriate Data Sheet. Verify that padding materials tested for performance characteristics do cover the head impact area as defined above. Refer to the measured compression deflection resistance value on the appropriate Data Sheet to determine compliance with the compression-deflection requirement and to determine the required padding thickness as indicated below:

RESISTANCE VALUE	MINIMUM THICKNESS
3.4 Kpa to 12.3 Kpa (0.5 psi to 1.79 psi)	19 mm (0.75 inches)
12.4 Kpa to 68.9 Kpa (1.8 psi to 10.00 psi)	13 mm (0.50 inches)

C.8 PROTRUSION LIMITATION (S213, S5.2.4)

Any protrusion, padded or unpadded, on a rigid structure, other than belts or belt hardware, that is contactable by any part of the appropriate dummy head or torso during the Dynamic Impact Test shall have a height above the immediately adjacent restraint system surface off not more than 9.525 mm (0.375 inch) and no exposed edge with a radius of less than 6.35 mm (0.25 inch). The areas to be considered include those identified in the sections on Torso Impact Protection and Head Impact Protection, with the addition of the surfaces directly forward of the 3-year-old or 6-year-old size dummy or directly rearward of the dummy and above its shoulders for restraints recommended for children weighing 10 kg (22 pounds) or more. This requirement does not apply to child harnesses consisting entirely of belt restraints.

Remove any padding in the applicable areas to make the measurements, and record the maximum values encountered on the Data Sheet.

12. COMPLIANCE TEST EXECUTION....Continued

D. DYNAMIC TEST CONDITIONS AND PROCEDURES (S213, S6)

Test a new specimen of the child restraint system according to the procedures below in each possible combination of installation mode, adjustment position, and proper-use/"misuse" mode. Record the particular combination to be tested as well as the test configuration to be used on the appropriate Data Sheet.

D.1 TEST EQUIPMENT

D.1.1 TEST CONDITIONS AND DEVICES (S213, S6.1.1.1)

The test device used to evaluate the dynamic performance of the add-on child restraint is the standard seat assembly securely attached to a dynamic test platform or impact sled. The standard seat assembly is described in Drawing Package SAS-100-1000, revised December 30, 1980 and including Addendum A, dated July 1, 1993. The orientation should simulate a vehicle frontal impact. The standard seat has three seating positions. The forward direction of the standard seat is defined by the Seat Orientation Reference Line (SORL), which is the horizontal line through point Z as illustrated in Figure 15. Additional belt anchor points and forward dummy excursion limits for dynamic test compliance are illustrated in Figure 16.

The standard seat assembly is covered by a seat cushion. The seat cushion is constructed of elastic-backed automotive vinyl on the upper surface, which is in contact with the child restraint, backed by a thin layer of nylon-impregnated vinyl (MIL SPEC 43006, Type 1, Class 2, Form 1, 350 lb. Ripping strength). The nylon-impregnated vinyl extends around the top of seam of the cover and is cross-stitched to the automotive vinyl on the seating surface.

The test device for built-in child restraint systems is either the specific vehicle shell or the specific vehicle.

SPECIFIC VEHICLE SHELL

- A. The specific vehicle shell, if selected for testing, is mounted on a dynamic test platform so that the longitudinal center line of the shell is parallel to the direction of the test platform travel and so that movement between the base of the shell and the platform is prevented. Adjustable seats are in the adjustment position midway between the forward-most and rearmost positions, and if separately adjustable in a vertical direction, are at the lowest position. If an adjustment position does not exist midway between the forward-most and rearmost position, the closest adjustment position to the rear of the midpoint is used. Adjustable seat backs are in the manufacturer's nominal design riding position.

12. COMPLIANCE TEST EXECUTION....Continued

If such a position is not specified, the seat back is positioned so that the longitudinal centerline of the child test dummy's neck is vertical, and if an instrumented test dummy is used, the accelerometer surfaces in the dummy's head and thorax, as positioned in the vehicle, are horizontal. If the vehicle seat is equipped with adjustable head restraints, each is adjusted to its highest adjustment position.

- B. The platform is instrumented with an accelerometer and data processing system having a frequency response of 60 Hz channel class as specified in Society of Automotive Engineers Recommended Practice J211 JUN80 "Instrumentation for Impact Tests." The accelerometer sensitive axis is parallel to the direction of test platform travel.

SPECIFIC VEHICLE

For built-in child restraint systems, an alternate test device is the specific vehicle into which the built-in system is fabricated. The following test conditions apply to this alternate test device.

- A. The vehicle is loaded to its unloaded vehicle weight plus its rated cargo and luggage capacity weight, secured in the luggage area, plus the appropriate child test dummy and, at the vehicle manufacturer's option, an anthropomorphic test dummy which conforms to the requirements of subpart B or subpart E of part 572 of this title for a 50th percentile adult male dummy placed in the front outboard seating position. If the built-in child restraint system is installed at one of the seating positions otherwise requiring the placement of a part 572 test dummy, then in the frontal barrier crash specified in (c), the appropriate child test dummy shall be substituted for the part 572 adult dummy, but only at that seating position. The fuel tank is filled to any level from 90 to 95 percent of capacity.
- B. Adjustable seats are in the adjustment position midway between the forward-most and rearmost position, and if separately adjustable in a vehicle direction, are at the lowest position. If an adjustment position does not exist midway between the forward-most and rearmost positions, the closest adjustment position to the rear of the midpoint is used.
- C. Adjustable seat backs are in the manufacturer's nominal design riding position. If a nominal position is not specified, the seat back is positioned so that the longitudinal center line of the child test dummy's neck is vertical, and if an anthropomorphic test dummy is used, the accelerometer surfaces in the test dummy's head and thorax, as positioned in the vehicle, are horizontal. If the vehicle is equipped with adjustable head restraints, each is adjusted to its highest adjustment position.

12. COMPLIANCE TEST EXECUTION....Continued

- D. Movable vehicle windows and vents are, at the manufacturer's option, placed in the fully closed position.
- E. Convertibles and open-body type vehicles have the top, if any in place in the closed passenger compartment configuration.
- F. Doors are fully closed and latched but not locked.

SLED SEAT FOAM

Before conducting a Dynamic Impact Test, measure the force-deflection characteristics of all four foam inserts used in the standard seat. Using the test methodology and apparatus described in this procedure for testing urethane-base materials, determine the load required to produce a 25% compression of the foam thickness. To be suitable for use in compliance testing, the foam inserts shall compress 25% under the following load limits:

51 mm (2-inch) thick foam: 20.4 to 24.9 kg (45 to 55 lbs)

102 mm (4-inch) thick foam: 9.5 to 12.2 kg (21 to 27 lbs)

If a foam insert has already been used in a Dynamic Impact Test, allow a minimum of twelve hours recovery time before measuring the force-deflection characteristics. Also inspect each used foam insert for damage or permanent deformation, and replace any insert judged to be defective.

TYPE I AND TYPE II BELT WEBBING

The webbing used for both the type I and type II belts are five-panel polyester webbing that complies with FMVSS 209 Seat Belt Assemblies. A new belt is used for each test performed.